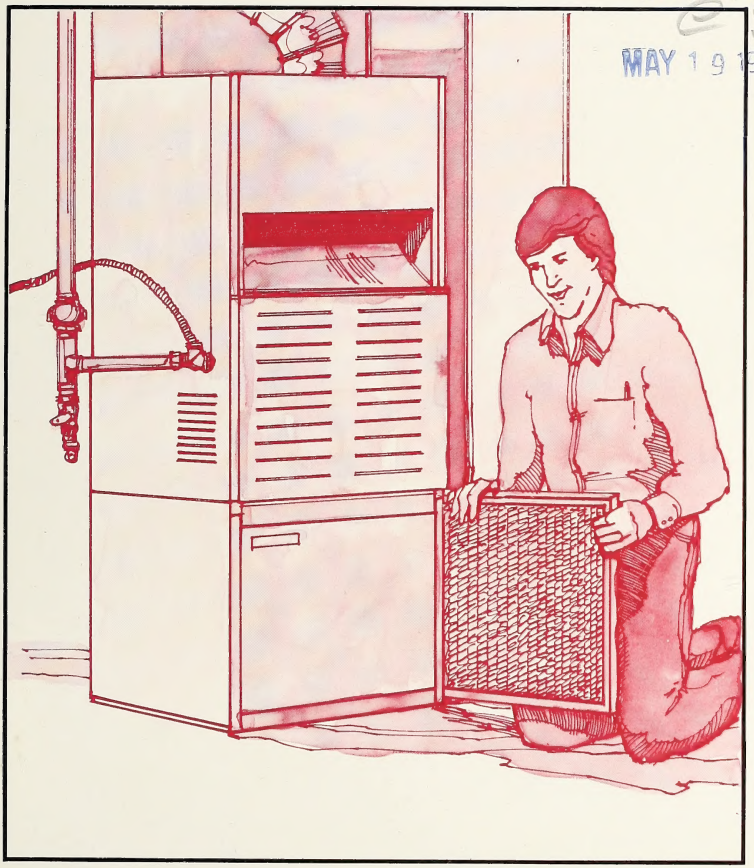
YOUR HOME HEATING SYSTEM 5

USING IT EFFICIENTLY



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WARNING: The circuit breaker supplying electricity to an electric water heater or furnace MUST be turned OFF prior to making any adjustments.

YOUR HOME HEATING SYSTEM
USING IT EFFICIENTLY

Three-quarters of the energy used in your home is for heating water and the interior spaces — the remainder is electrical energy for lights and appliances. Maintenance of water and space heating systems helps ensure that this energy is used as efficiently as possible. Much of this maintenance, including one or two adjustments to furnace and hot water tank operations, is simple enough for the average homeowner to carry out. The efficiency of a well-maintained and utilized system may be 20% to 30% greater than that of a neglected, poorly operated one. This can mean an energy saving of $80 to $120 per year.

Total energy consumption in the home depends on factors such as your family's size, the ages of its members, its lifestyle, hobbies, even the number of pets! There are many ways to lower your total fuel consumption besides the ones emphasized in this publication:

- Increase the airtightness of your home with added weatherstripping and caulking.
- Improve the insulation value of walls, ceilings, and foundations.
- Reduce electrical energy consumption by using efficient lighting, by selecting and properly using energy-conserving appliances, and by developing energy-conserving living habits.

A. WATER HEATER MAINTENANCE

Although hot water heaters have no moving parts, they will wear out over a period of time. You can improve their life expectancy and efficiency with proper maintenance which consists mainly of periodic **draining** to keep sediment from building up in the tank. Every one or two months, water should be drained from the outlet at the base of the tank (Figure 1). Drain 8 to 10 litres (2 gallons) of water until it runs out clear, indicating the sediment has been removed.

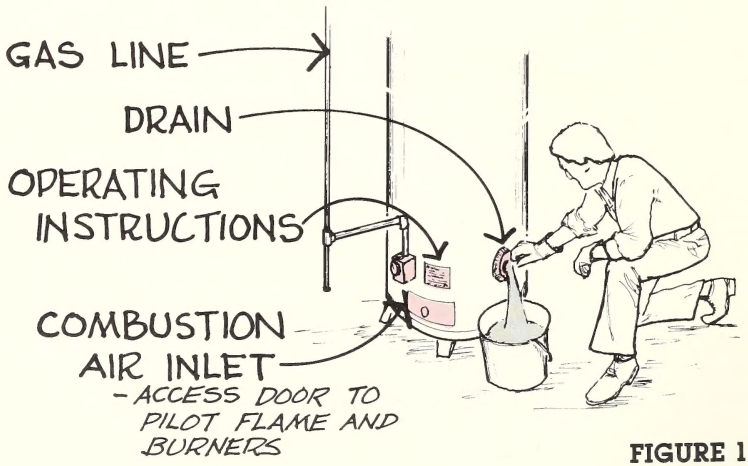


FIGURE 1

Once a year the entire tank volume can be drained to flush out rust, scale and sediment. This build-up will decrease the heat exchange efficiency of the tank and may contribute to corrosion of the interior if not removed periodically. The degree of deposit will depend on the mineral content of your water supply.

Do not attempt to completely drain your gas-fired water heater unless you feel confident that you can re-light the pilot flame.

Before draining the tank, turn the gas control to "off". If you have an electric water heater, shut the power off at the circuit box. To drain the tank, shut off the main water supply to the tank, open a hot water tap located above the tank (for example, the kitchen faucet), then open the tank drain. If the tank has not been drained for a few years, be careful not to force the drain if it is corroded shut. When your water heater has been drained and refilled, remember to re-light the pilot flame or to turn the power supply back on.

For best efficiency, the water **temperature** should be no higher than required. If you use an automatic dishwasher, the maximum water temperature should be 60°C (140°F). If not, the temperature should be set so that you can just tolerate the hot water on your hand. This is especially important, from a safety viewpoint, when you have small children in your home. Alter the temperature using the control dial on the gas-fired water heater (Figure 1). If you have an electric water heater, the temperature can only be altered after removing cover plates and making the adjustments with a screwdriver. (Consult the service manual provided with the water heater).

You can increase the efficiency of the hot water system with tank and pipe insulation (see Figure 2). Wrapping a hot water tank with insulation decreases the "stand-by" heat loss from hot water in the tank. Older tanks in particular benefit because they are not as well insulated as newer models. You can purchase a kit or do the work yourself with batt insulation, duct tape and heavy polyethylene. When insulating a gas-fired water heater, make sure the top is not covered (so that the draft hood is not blocked) and **do not cover the air inlet**, the controls, or the operating instructions for the burner and pilot light.

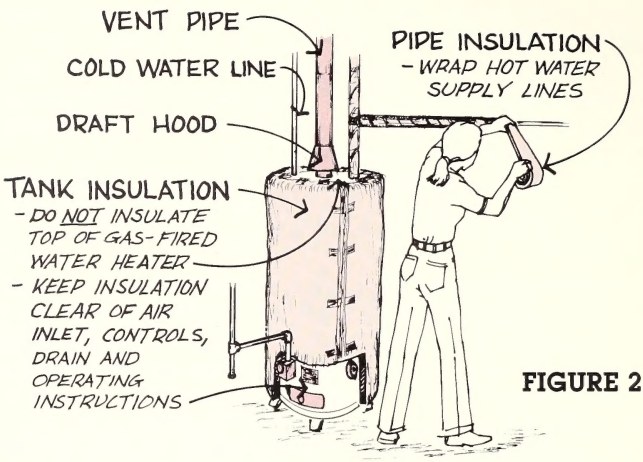


FIGURE 2

Insulation can be applied to the hot water supply lines and may prove economical both in terms of energy and water costs since less water is used to bring hot water to a faucet.

If you are leaving your home unoccupied during a long holiday, and if you feel confident about re-lighting your gas water heater, you can save energy and money by shutting off the water heater while you are away.

B. HEATING SYSTEM MAINTENANCE

Your home probably is heated with a natural gas-fired forced air, gravity or hot water heating system if you live in Alberta. The maintenance of these different systems is covered in the following sections but one requirement they have in common is the need for fresh air — for combustion and for proper chimney operation. Most existing homes rely on air leaking in through cracks and joints for this fresh air supply.

To reduce heat loss, air leakage should be minimized by improving the airtightness of your home. This is outlined in another publication in this series, **How to Weatherstrip and Caulk Your Home**. Reducing air leakage will, however, also restrict the air supply that previously "leaked in" to your furnace. Adding an air supply duct to the furnace area may be required.

By isolating the furnace or boiler (and gas-fired water heater) in a sealed, insulated room with its own outside air supply as shown in Figure 3, the air supply can be "controlled". Only fresh, outside air is used for combustion — not previously heated house air. And only outside air will enter and move up the chimney when the furnace is not operating. The fresh air inlet duct, which must meet building code requirements, can draw air directly from outdoors or from the attic. If additional fresh air to the living quarters of your home is required, a separate fresh air supply to the return air duct of the furnace can be added. If you are considering enclosing the furnace and water heater, be sure to maintain proper clearances from combustible materials.

A lot of heat produced by a conventional furnace is lost up the chimney. This is necessary in order to remove water vapour produced during the combustion process. Adding "heat reclaiming" devices to the flue is not only illegal but also very dangerous. The water vapour may condense at lower temperatures causing corrosion, or it may freeze, blocking the chimney in very cold weather — especially important in view of Alberta's climate. New, high-efficiency "chimney-less" furnaces designed to eliminate this problem are discussed in another publication in this series, **Selecting a New Furnace**.

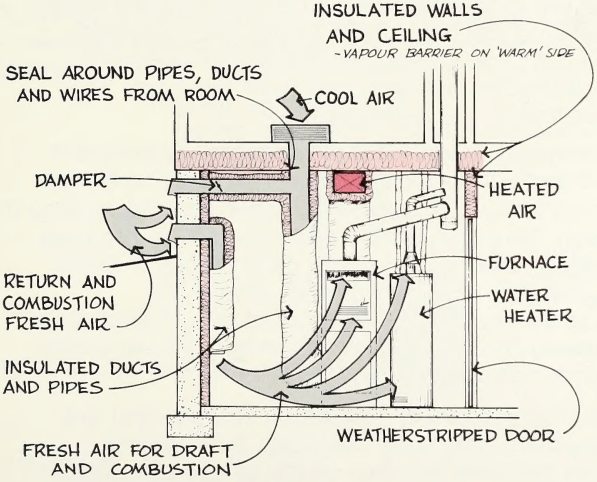


FIGURE 3

1. Forced Air Systems

A typical forced air system is shown in Figure 4. Proper and efficient operation depends primarily on maintaining an unobstructed air flow through the system for heat distribution.

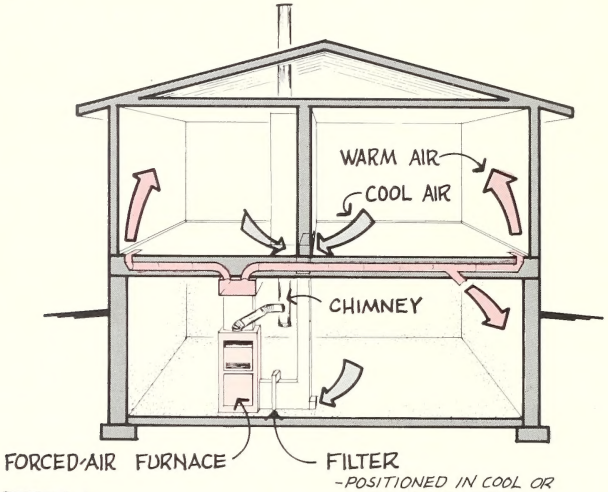


FIGURE 4

The easiest yet most effective part of maintaining system air flow is keeping the filter clean. If the filter becomes clogged and dirty, air movement slows and efficiency drops because heat is not removed from the heat exchanger as fast as it is produced.

The most common styles of filters used are illustrated in Figure 5. The disposable types, usually of cardboard and fibreglass construction, should be changed monthly during the heating season. Permanent-type filters should be cleaned by vacuuming or washing monthly. Other types of filters, such as electronic or charged media, should be maintained as outlined by the manufacturer. Usually, they too will require a monthly cleaning cycle or replacement during the heating season.

Keeping the entire duct system clean will prevent the filter from clogging frequently. Remove the registers (diffusers) and vacuum the duct as far as you can reach

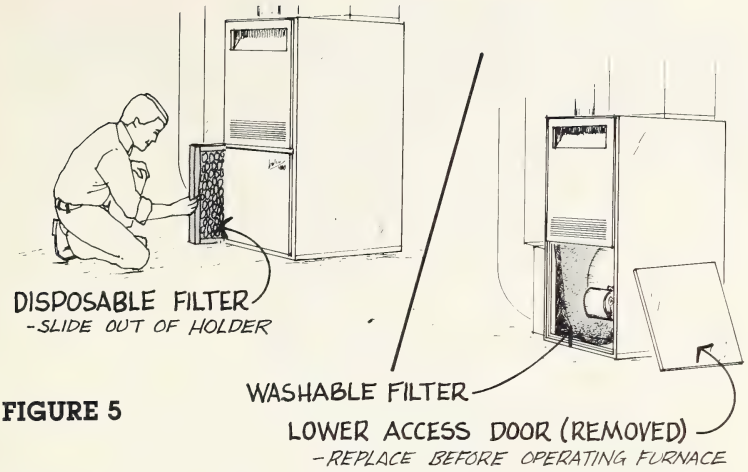


FIGURE 5

to remove most of the dust and dirt. If you suspect heavier amounts of dirt, a commercial furnace and duct cleaning service may be hired to clean the entire system.

Air flow also depends on the condition of the motor and blower. Lubrication of the bearings twice a year should be the only maintenance required. After **turning off the power** to the furnace, remove the lower access panel to expose the motor and blower assembly. Add 5 or 6 drops of a non-detergent electric motor oil to each oil port (see Figure 6). If there are no oiling ports, the motor and/or blower has sealed bearings requiring no external lubrication.

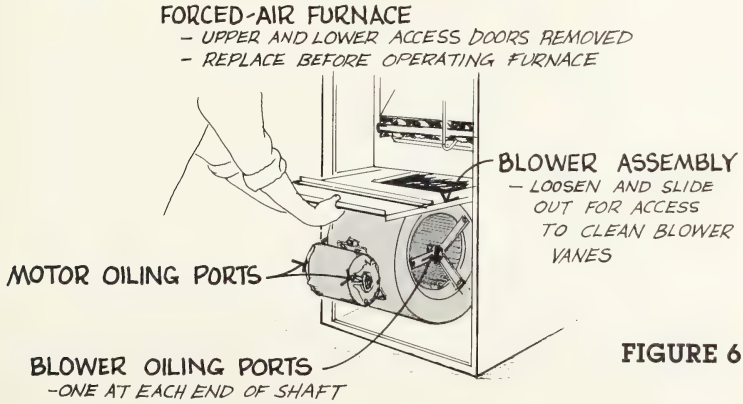


FIGURE 6

If your fan is not directly driven (with the motor mounted inside the fan assembly), the belt drive between the motor and blower fan should be checked. Proper tension can be set by changing the angle of the motor. There should be 20 mm to 30 mm (¾ in. to 1¼ in.) of slack in the belt midway (as shown in Figure 7).

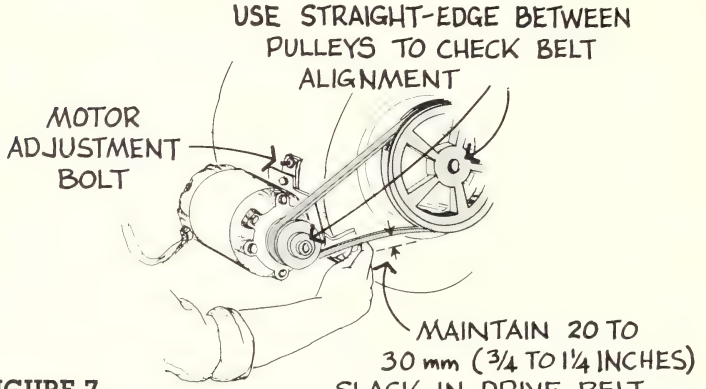


FIGURE 7

Check the belt condition and alignment at this time. Again **make sure the power is off**. If the belt is cracked, frayed or worn, replace it. Loosen the motor, remove the worn belt, install a new one of the proper size and adjust it to the proper tension. Use a strain edge or look along the belt to see if the pulleys are lined up properly. If the pulleys are not aligned, loosen the motor pulley, slide it one way or the other on the shaft, then retighten the pulley.

While the lower access panel of the furnace is removed, look at the blower vanes. Any soil build-up on the vanes will impede efficient operation and air flow. Loosening a few bolts will usually allow the assembly to be exposed enough to scrape and vacuum the blower vanes (see Figure 6). Competent homeowners should be able to clean the blower fan themselves, although this operation may best be left to a service representative.

Remount the motor/blower assembly, then replace the lower access door and turn the power back on to the furnace before leaving this area of maintenance. **Do not operate the furnace without all access doors in place**.

As a further step towards efficient forced-air furnace operation, minimizing the cyles of starting and stopping can improve efficiency. The ideal situation is to have the proper furnace size installed in your home — the furnace should operate 100% of the time during the coldest days of the year. However, it is probably not worth replacing your furnace for this reason alone.

If your furnace burners cycle on and off for short periods while the blower operates constantly, the air volume may be too low. It will not remove the heat fast enough from the heat exchanger either because the blower fan is running too slowly or because it is dirty.

The speed of the blower fan can be increased by changing the diameter of the motor pulley (or by tightening the belt if it is loose and slipping). **Remember to turn the power to the furnace off before making any adjustments**. Most motor pulleys are variable-speed types and can be increased in size (speeding up the blower) by loosening a locking screw, twisting the pulley halves closer together, then retightening the screw (see Figure 8). Adjust the pulley in small steps until frequent burner cycling stops. Although best left to a service representative, the competent homeowner can make this adjustment.

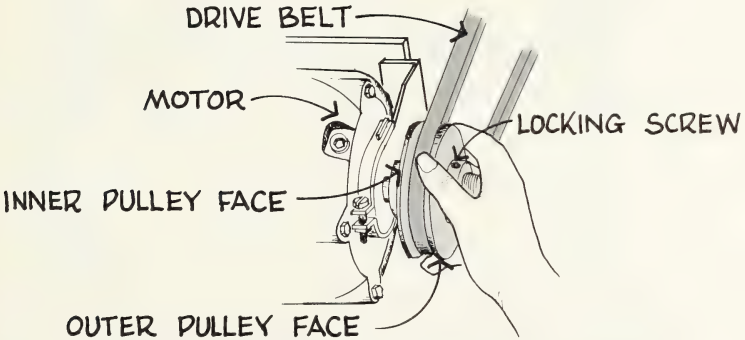


FIGURE 8

If the blower cycles on and off frequently, the fan-control switch or thermostat anticipator may need adjustment. Altering the fan-control (usually located in a control box in the furnace) to lower "start" and "stop" temperatures will make the blower fan start sooner and run longer during the furnace heating cycle. The thermostat anticipator, a movable pointer near the edge of the thermostat (under the cover), is normally set to the amperage listed on the furnace control valve. Moving the pointer to higher settings, 0.1 ampere at a time, will help prevent frequent furnace cycling.

Both fan-control switch adjustments and thermostat anticipator alterations are best done by a qualified heating contractor. However, if you do attempt to make these adjustments yourself, **be sure the power to the furnace is turned off**.

2. Gravity Systems

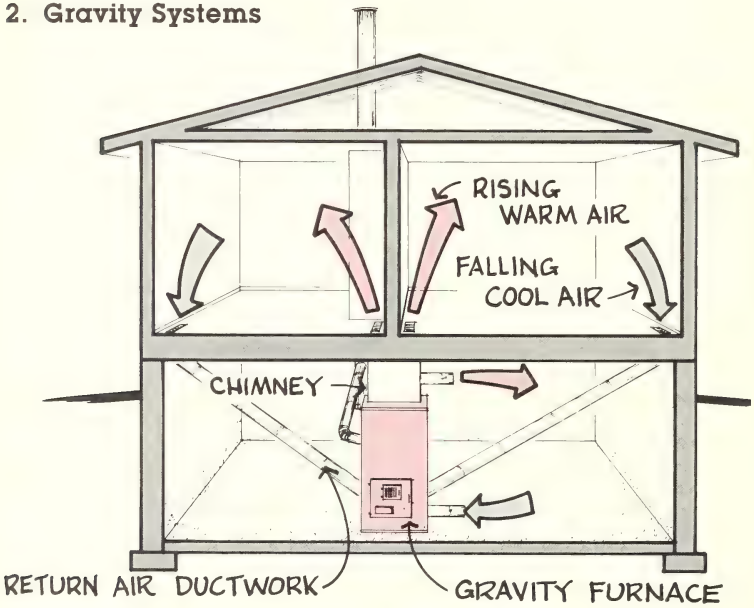


FIGURE 9

Figure 9 shows how a gravity heating system works. The action of heated air rising and cooled air falling circulates heat from the furnace throughout the home.

Since convective air flow distributes heat, the major maintenance involved in a gravity system is keeping the duct system clean and unobstructed. It is very important that both supply and return air ducts be free of any build-up of dirt and that no furnishings be placed over the grilles. Gravity systems usually rely on thermostats for temperature control, so lowering the temperature settings at night will pay off as for forced air systems (discussed in section "C").

3. Hot Water (Hydronic) Systems

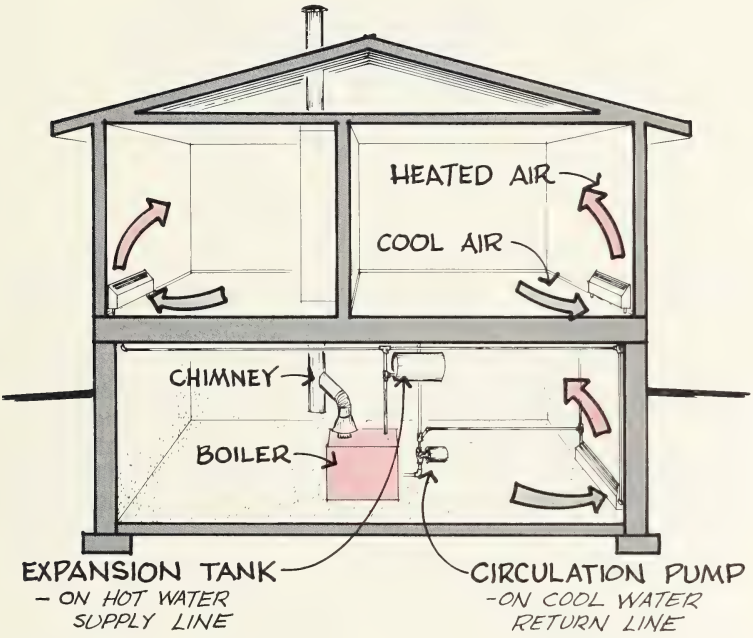


FIGURE 10

The layout of a typical residential hot water heating system is shown in Figure 10. There are various systems in use (series loop, one pipe, two pipe, etc.), but most rely on a circulating pump to move hot water through baseboard convectors to heat the air in the home.

A minimum of maintenance is required with a hot water heating system. Lubrication of the circulation pump twice a year is important. Place a few drops of non-detergent electric motor oil into the oil cups at both ends of the motor and on the top of the bearing assembly between the motor and pump body (see Figure 11).

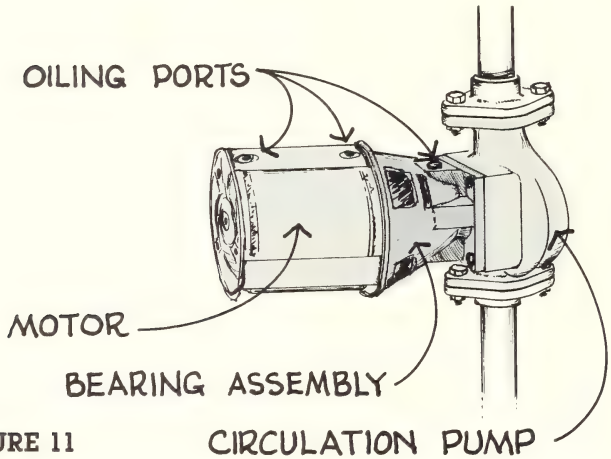


FIGURE 11

Other servicing requirements include bleeding air from the system, maintaining the water level and occasionally adding corrosion inhibitor. Procedures for adding water and removing excess air vary among systems. Consult service manuals or a heating contractor for information on these maintenance operations.

C. THERMOSTAT SETBACK

A large potential energy saving is possible by turning down your thermostat during the night to 17°C (instead of leaving it at 20°C) and by leaving it at 17°C during the day if no one is home. This energy saving is available at no extra cost by setting the thermostat back manually.

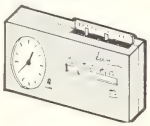
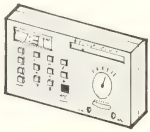
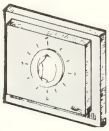
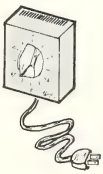
Automatic setback thermostats will ensure settings are altered each and every day. "Override" switches on the thermostats enable you to bypass the automatically lowered settings (on a weekend, for example, when everyone is home during the day).

FIGURE 12

Automatic setback thermostats operate by using a 24-hour clock or timer which can be programmed to raise and lower the temperature settings for specified periods. Some units can control two or three setback periods per day; other units only offer one period. Some units can be added to your present thermostat, while others replace it completely. Most replacement-type units will use the existing two low-voltage wires from your furnace for operation.

Most automatic setback thermostats can be installed by the homeowner. Those that require additional wiring may pose problems if new wiring cannot easily be threaded through the wall. Remember, when installing or replacing a thermostat, to place it on an inside wall away from drafts, direct sunlight or heat sources (such as a refrigerator, heat ducts or chimney behind the wall, etc.). Mount it about 1.5 m (5 ft.) from the floor and away from heavy traffic areas.

Instructions provided with the units give details on installation and operation of the setback features. The following is a breakdown of costs and features for different types of automatic setback thermostats available.

TYPE	1982 COSTS	FEATURES
Automatic Clock	$100-$200 	• Up to 3 setback periods per day • Setback periods can be 1 to 23 hours • Usually has clock face • Usually replaces existing thermostat
Programable	$100-$300 	• Up to 4 setback periods per day • Setback periods can be ½ to 23½ hours • Expensive • Replaces existing thermostat • Automatic override for weekends • May lose memory during power outages (unless battery-powered) • Usually has clock face
Semi-automatic Timer	$40-$60 	• Usually only one setback period per day • Timer must be wound each evening for setback cycle • Setback period can be 2 to 12 hours • Usually replaces existing thermostat • Timber may be noisy
Sensor Type	$50 	• Only one setback period per day • Sensor purchased determines setback temperature (usually 5°C, 7°C, or 10°C) • Setback period can be ½ to 23½ hours. • Can only change setback temperature with different sensor • Replaces existing thermostat
Thermostat Heater	$30 	• Uses 120V power (requires outlet near thermostat) • Only one setback period per day • Setback period can be ¼ to 12 hours • Mounts under existing thermostat (heater "fools" thermostat into not calling for heat)

D. SAFETY

Family and personal safety should be your primary concern during appliance maintenance. Remember that for safe operation, gas-fired appliances need an air supply and must be properly vented to a chimney.

Visually inspect the vent connection pipes to the chimney from the furnace or boiler and gas-fired water heater (see Figure 13). Check that all the joints are tight and securely fastened. Note carefully if there are any rusted or "soft" spots in the pipes. If holes or gaps appear in the venting system, there is a potential for harmful by-products of combustion to be leaked into the home. Have deteriorating pipes replaced immediately. The top of a metal chimney should also be periodically inspected for deterioration.

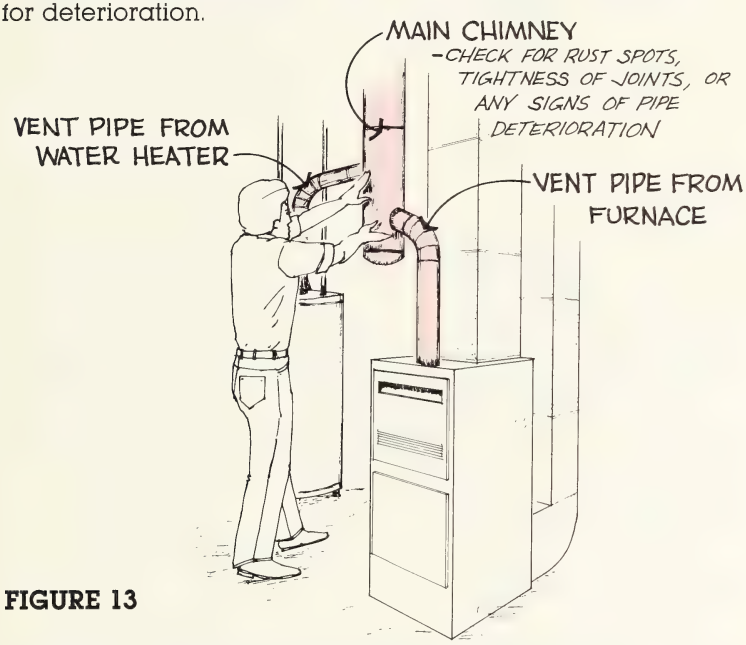


FIGURE 13

Masonry chimneys must be lined to be used for exhausting gas appliances. With a mirror in the cleanout access, visually inspect the chimney lining and check for blockages. Make sure all openings, other than those servicing the furnace and hot water heater, are closed off. Any openings for a kitchen range or space heaters used in the past should be bricked over.

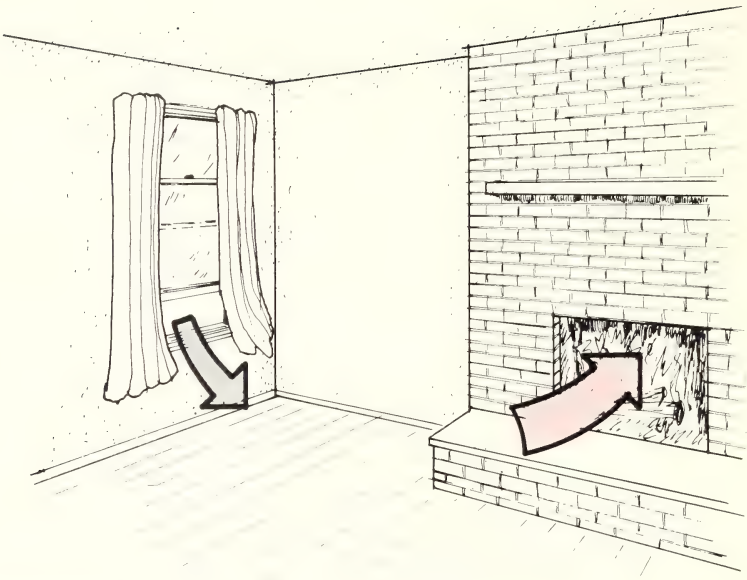


FIGURE 14

Check for obstructions to the air supply. Do not store or place any items close to the furnace or hot water tank. Ensure that they are not enclosed in a small area with no combustion air supply and never operate them with any access panels removed.

Signs of excessive carbon or rust deposits, escaping fumes or irregular flame patterns should be reported immediately to your utility company. If there is a gas odour present, ventilate and evacuate the area and avoid flame or electrical spark sources (such as light switches) while waiting for the utility company representative to arrive.

A shortage of combustion air can be caused by an open fireplace or wood stove in the house, using available air and creating a negative pressure in your home. Wood stoves and fireplaces should have their own combustion air supply to prevent them from affecting your furnace or water heater. If they do not, open a nearby window to supply extra air.

E. HOME HEATING SYSTEM MAINTENANCE: A REVIEW

- Inspect all vent and chimney connections for looseness, rusting or deterioration.
- Clean air filter monthly during heating season.
- Set water heater temperature as low as possible.
- Lubricate blower motor (or circulation pump) and check belt drive twice a year.
- Clean blower and registers of dust and obstructions once a year.
- Drain water heater periodically.
- Set back temperature at night and when no one is home. Consider an automatic setback thermostat.

Proper furnace and water heater maintenance makes sense. You will reduce fuel costs, extend the life of your equipment and have a safer system by following this simple maintenance schedule.

NOTES